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Visible Labour? Productive Forces and Imaginaries of Participation in European Insect Studies, ca. 1680–1810**

Dominik Hünniger*

Summary: The practice of early modern natural history depended on the collective collecting activities of a great variety of people. Among them, artisans played a major role in acquiring and distributing knowledge about the natural world and they contributed significantly to the scholarly labour in natural history. This distributed labour was both acknowledged by contemporaries as well as hidden from sight, reflecting the period's dominant norms for class and gender. By combining an interpretation of the visual representation of labour in European insect studies with an examination of written sources about natural history practices from about 1680 to 1810, this article decodes the often-codified frontispieces and other more symbolic illustrations to offer new insights into the labour of natural history. Those who identified as scholars and artisans (or both) conceptualised their own intellectual and practical engagement with natural history within the semantic field of work. Some seemed to have even envisioned a new social role for academics as well as artisans. This article analyses the diversity of the "productive forces" in insect studies as they changed over time and it reconstructs what I will call the social imaginaries of participation.

Keywords: visual history, entomology, labour, art, illustration, insects, artisans, observation, collecting, natural history

D. Hünniger
University of Hamburg
E-mail: dominik.huenniger@uni-hamburg.de

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1. Introduction: Between Labour and Leisure – Visual Histories of Science

In a manuscript entitled, "My leisurely hours" (*Meine Erholungs Stunden*), the then twenty-four-year-old Swiss draughtsman Johann Rudolf Schellenberg (1740–1806) recorded his scientific interest in insects and other natural history observations.[1] The title of the manuscript itself refers to the fact that Schellenberg earned his living as a draughtsman, providing illustrations for scholars and authors; he thus needed to confine his own scientific work to the "leisurely hours." For the title illustration (Figure 1), Schellenberg positioned his self-portrait as "pictor" (painter) against an idealised landscape that is surrounded by a body of water and includes two putti holding collecting tools. The scene also contains several insects and amphibians, a microscope and a glass jar. The two child-like figures represent manual as well as intellectual labour. As putti they are personifications of embodied insect collecting practices, including the use of specific tools. As genii they refer to the thought processes and labours of the mind also at work in natural history. Schellenberg's image is therefore the perfect illustration to frame this article in which I will scrutinise the relationship between labour and leisure, their visibility or invisibility, and the productive forces (intellectual and physical) enabling knowledge production through text and image in eighteenth-century entomology.[2] The maker of the image, the artisan/scholar Schellenberg and his illustrations and texts will feature prominently; although attention will also be paid to other (sometimes unnamed) knowledge workers.

The study of insects, or entomology as the scientific discipline is known, is a field that depends on the collaboration of many practitioners and the exchange of knowledge and specimens. As in other sub-disciplines of natural history, this collaboration was already acknowledged in the early modern period, albeit with different degrees of transparency about who, exactly, was making knowledge. Indeed, as Lorraine Daston and Peter Galison have argued, collaborations of naturalists and artists "were taut with tensions: social, intellectual, and perceptual."[3] Daston and Galison have analysed these tensions mainly for the production of abstraction and the creation of ideal types of natural subjects, which exhibited the epistemic virtue of "truth-to-nature." As this article will show, natural historical labour, both manual and intellectual, was also typified, specifically in the form of putti representing practices as well as practitioners.

Because taxonomic texts, catalogues of collections and reports on expeditions remain largely silent about the vast number of participants involved, I

[1] Johann Rudolf Schellenberg, "Meine Erholungs Stunden," Basel, 1764, Universitätsbibliothek Basel, K III 2, online: https://doi.org/10.7891/e-manuscripta-12892/ Public Domain Mark (accessed 23 April 2021). On Schellenberg, see: Thanner 1987; Thanner et al. 1987.

[2] Of course, manual and intellectual labour are entangled practices. For the complicated and multifaceted relationship between minds and hands in the history of science, see: Roberts et al. 2007.

[3] Daston and Galison 2007, on 88. On the issue of collaboration in botany, see Dietz 2017.

Figure 1. Johann Rudolf Schellenberg: „Meine Erholungs Stunden," Basel, 1764, Universitätsbibliothek Basel, K III 2, online: https://doi.org/10.7891/e-manuscripta-12892 (accessed 23 April 2021).

will focus here on images in order to make the labour and "productive forces" of knowledge production on insects visible.[4] The Marxist term "productive forces" is chosen deliberately here as its analytical power lies in the intrinsic entanglement of the means of production (tools as well as infrastructure) with human labour power (manual and intellectual).[5] I will also show how the relative visibility of labour, and the imaginaries of participation illustrated by European artists, was shaped by long established social hierarchies in Europe and its colonies. Frontispieces, vignettes and illustrations of specimens in entomological books depict a wide variety of spaces and practitioners active in "making and knowing," reflecting the importance of the mechanical arts,

[4] E.g. for recent attempts to reconstruct the great variety of participants, see: Murphy 2020; Ruhland 2018; Schaffer et al. 2009; Manning and Rood 2016; Hellawell 2019.

[5] My attention to the intellectual history of "forces" and the analytical power of "imaginaries" owes much to discussions in the DFG Centre for Advances Studies "Imaginaria of Force" at the University of Hamburg. See Fehrenbach et al. 2018.

artisanal workshops and households for the history of science.[6] Through an exploration of the work of visual artists and craftspeople, their importance in processes of knowledge formation becomes visible. Kärin Nickelsen's recent overview on the use of images in the history of natural history summarises this aptly: "Images were an integral part of taxonomic research and […] education. They contributed in important ways to the increasingly professionalised training of experts in pharmacy, forestry and agriculture and they served as references in scholarly debate."[7]

Although the history of entomology is one of the least studied subfields in the history of natural history, historians of insect studies have regularly foregrounded images as important sources for their work. Janice Neri's magisterial *The Insect and the Image* is a prime example of this kind of scholarship and will serve as an important framework for this article. Neri stresses the importance of co-operation across class boundaries, which goes beyond the usually quite homogenous world of the "Republic of Letters." As she argues, both the practitioners of insect studies as well as the settings of entomological inquiry have been quite diverse: "The process of organising, describing, representing, and displaying nature was […] done in collaboration with others in professional and domestic settings such as museums, classrooms and artists' workshops."[8] Neri also emphasised how frontispieces are important examples of the "ways that visual images continued to shape both the European vision of nature and the construction of an artist's persona well into the eighteenth century and beyond."[9] Schellenberg's *Erholungs Stunden* is a prime example for this nexus between imagining nature itself and the artist as naturalist.

In Europe, artisans contributed significantly to the scholarly labour of natural history, but their own voices are often lost. The self-fashioning of the creators of images can be explored even when they have left little or no written evidence about their work. The often-codified frontispieces and other more symbolic illustrations, which contain the social imaginaries of participation in natural history, play a critical role in this regard. These depictions and narrations of labour make visible the diversity of the "productive forces" in insect studies as they changed over time. This article therefore performs two related tasks. Qualitative and quantitative methods, close and distant reading of images and texts, as well as careful attention to the (social) mechanics of collaboration will reveal the diversity of knowledge makers and the centrality of labour in natural history. Similarly, I will explain why, when, in what ways, and for what reasons labour was made visible, or invisible for that matter, in contemporary discourse and image-making practices.

[6] Smith et al. 2014 and Bertucci 2017. For frontispieces as a source for the history of science, see Remmert 2011. For an overview on the visual culture of science, see Hentschel 2014. On the complicated interplay between visibility and invisibility, see Bertucci 2013.

[7] Nickelsen 2018, on 222.

[8] Neri 2011, on XIX. See also: Ogilvie 2013; Bass 2019.

[9] Neri 2011, on 180.

Inspiration for the following derives from studies of related scientific practices in other spaces of knowledge making, namely the laboratory and fossil collections. Steven Shapin has shown how the "moral economy of the laboratory" rendered some work and workers invisible which had important consequences for how knowledge was constituted, valued and validated.[10] In a similar vein, Lydia Barnett recently argued that both hiding as well as showing the labour of working-class suppliers of natural objects like fossils could serve higher ranking naturalists in demarcating cultural, social, economic, racial, and/or gendered boundaries.[11] Hence, the entomological images under review here relate to early modern and especially eighteenth-century developments affecting all realms of natural science knowledge production. It is important to note that allegorical images writ large "emblematize a social type," or a certain set of practices, rather than individual persons.[12] Following Barnett's reading of the parallel processes of showing *and* hiding, I am therefore proposing that a closer look at the images themselves, as well as the "productive forces" behind them, can reveal much of the epistemological work that the images performed. In contrast to Barnett's "earth workers," however, the artists, like Schellenberg, who are the main characters of this story are closer in social status to the scholars with whom they collaborated.

The main characters, literally, of my analysis – allegorical representations of manual and intellectual labour in the form of putti – have received little attention in the history of science. This underutilization is even more striking in view of the ubiquity of putti on vignettes and frontispieces in all kinds of natural history, natural philosophy as well as art (historical) treatises throughout the early modern period and even beyond. A serious engagement with these allegorical figures will go beyond John Heilbron's *Domesticating Science.*[13] Like much of the scarce literature on putti in science, Heilbron focused almost exclusively on what we would now call the exact sciences, and so missed important aspects of what putti were meant to represent in other fields of knowledge formation on nature, namely natural history or the life sciences. This article therefore goes beyond the alleged origins of "employing" putti in illustrations to Catholic, specifically Jesuit, scientific publications. As most of the examples used here come from Protestant Europe, it will also become clear how putti transcended confessional boundaries for much longer than Heilbron and others have suggested. The connection of putti to the history of observation, however, is a valuable one for this case study, too, albeit in a somewhat different form. The often-quoted dictum by Athanasius Kircher that perfectly exact observation and measurement can only be performed by angels, further obscures an entirely different purpose of putti in illustrating scientific practices.[14] Exact observation was very much a part of insect studies, too, but

[10] Shapin 1994, esp. the chapter "The invisible technician."

[11] Barnett 2019.

[12] Ibid., on 248.

[13] Heilbron 2000. I am very grateful to Rebekah Higgitt, Edinburgh, for recommending Heilbron's article.

[14] Ibid., on 7.

this was not so much about measuring weights, lengths and widths, etc. but rather about observing the whole or parts of the morphology of organisms and the visual and textual reproduction of these observations in communications with fellow entomologists.

Prior literature also stressed that putti were mainly used to visually separate manual from intellectual labour, the bodies from the minds of knowledge makers and play from work. As Nick Wilding summarises: "Over the course of the seventeenth century, they were made to work harder, often becoming a visual euphemism for manual labour itself, clearing the space of experimentation of labourers' bodies. They stand in for technical expertise and guarantee experiments' success."[15] This is certainly an important point but a more complex history of putti at work emerges when taking the creators of the images as well as the collaborative nature of their productions more seriously. Manual as well as intellectual labour will appear more closely related, especially in rare but significant cases, like Schellenberg's, when we see both the minds and hands of marginalised knowledge workers in action. Schellenberg and other artisan/scholars were more aware of the entanglements of minds and hands, of mental as well as of manual work, and the relationship between leisure and labour more generally.

2. Beginnings: Scholars and Artists in their Studies and Outdoors

It is striking how one of the earliest images of collaboration in insect studies depicts the issues introduced above, albeit without the presence of putti. Jan Luyken's frontispiece to Stephen Blankaart's (1650–1704) *Schou-Burg* (Figure 2) published in 1688 shows two important settings, the "home" (possibly more specifically the study as a separate room) and the "field" in both of which two people are exploring nature together.[16] As Saskia Klerk has noted, the image depicts a "space half inside, half outside."[17] The gestures used by the figure on the left within the space of the "home" and the figure on the right outside in the "field" both suggest instruction. The dress of the two men at the table also suggests a social hierarchy, or at least a professional one: the left-hand figure is clearly depicted in a (scholarly) housecoat whereas the person on the right could depict an upper-class patron or possibly even a wealthy student. It is not unlikely however that the figure is simply a fellow naturalist visitor. In any case, it depicts communication between two people interested in the study of insects and highlights the collaborative nature of insect studies which has been acknowledged in many histories of entomology. In fact, the widespread

[15] Wilding 2011, on 77. Heilbron already mentioned these aspects too. See also Schaffer 2011 for cursory remarks on Newton and putti.

[16] Blankaart 1688. For more on Blankaart's natural history practices, including a discussion of the labour of raising insects, see: Klerk 2020; Jorink 2010. On the "field" as an important site of natural history see: Hodacs 2010; Harbsmeier 2012.

[17] Klerk 2020, on 22.

Figure 2. Jan Luyken, title page of Blankaart 1680, etching on paper, 145 mm x 86 mm, Rijksmuseum Amsterdam, RP–P-1896-A-19368-667, online: http://hdl.handle.net/10934/RM0001.COLLECT.143352 (accessed 23 April 2021).

participation of many practitioners was and is one of cornerstones of natural history practice, especially in taxonomy. Contributors to entomological knowledge came from diverse social, regional and professional backgrounds.[18] Indeed, until today entomology, like other branches of the biological sciences, relies heavily on the work of "amateur" scientists, especially in the recording of

[18] See: Phillips 2012; Wale 2018. See also Wale 2019 for the wide variety of entomological practitioners. For recent assessments of the history of natural history more broadly, see: Curry et al. 2018; MacGregor 2018.

biodiversity and populations. In German, the most commonly used term was *Liebhaber*, which denotes more expertise than the modern term "amateur" does.[19]

One of those well-known *Liebhaber* was the German pastor Friedrich Christian Lesser (1692–1754). For Lesser's *Insecto-Theologia* published in 1738 (Figure 3), the engraver Christian Friedrich Boetius depicted the naturalist also in a housecoat but in a much more modest setting in a room shared possibly by his wife, who is busy at the spinning wheel, reminding us again of the household as an important setting for both "cottage industry" and natural inquiry. The image also literally erases the borders between house and outside. This is a recurring feature of the depiction of natural historical labour, as we have already seen in Jan Luyken's illustration for Blankaart's *Schouburg*. The woman at the spinning wheel, working close to but separate from the naturalist, belies the important role of women in natural history. In the history of entomology, Maria Sibylla Merian (1647–1717) clearly overshadows most other entomologists, men and women, and even people without any knowledge of the history of the discipline will surely have heard her name or seen one of her illustrations. She has rightly received much attention as an artist, traveller and as a precursor of ecological thought.[20] It is important to note that a substantial number of female illustrators followed the famous example of Merian and worked on lavishly illustrated tomes often produced from rich insect collections owned by wealthy patrons of the sciences.[21] These collections were the most important sites of entomological knowledge production in the eighteenth century.

3. Labour in Natural History Collections

Much like households or workshops, cabinets of natural history and other collections have recently been highlighted as key sites of early modern science.[22] The latter are especially suited for such an investigation for two reasons: first, collections were and are the main sites of knowledge production on insects since the Renaissance and, secondly, contemporaries already acknowledged their importance to the structural layout and organisation of natural historical labour. Both are clearly noticeable in Johann Christian Fabricius's description of the "daily workers" at Joseph Banks's house and collections. Like Fabricius, many other contemporaries described Banks's house in London as the "meeting

[19] For the complicated relationship between "amateur" and "professional" in the history of science, see also Pandora 2016 who unfortunately neglects the pre-nineteenth century developments.

[20] See, most recently, Etheridge 2020. The in/visibility of colonial labour in entomology will be further explored in a monograph on insect studies in the long eighteenth century.

[21] See the substantial bibliographies: Horn and Schenkling 1928; Nissen 1969.

[22] Cooper 2006; Yale 2019; Werrett 2019b; Van de Roemer 2004; Roos 2019.

Figure 3. Christian Friedrich Boetius, frontispiece to: Friedrich Christian Lesser, *Insecto-Theologia*, Leipzig: Groß, 1758), Universitätsbibliothek Erlangen-Nürnberg, H61/TREW.Hx 718, online: urn:nbn:de:bvb:29-bv009185335-9 (accessed 23 April 2021).

place" for those who "cultivate the sciences."[23] Fabricius was one of those visitors who explicitly mentioned the separation and allocation of specific work in Banks's house: the president of the Royal Society seemed to have known

[23] Faujas de Saint-Fond 1797, on 6–7. The Danish entomologist Fabricius is one of the many parents of modern entomology and Banks's collection was one of the richest in Europe at the time. Banks's role in the development of natural history and collections is well known, as is the importance of continental European visitors and assistants in shaping the collections and spreading the word about Banks's explorations and collections. See the most recent collections: Goodman 2019; Werrett 2019a.

how to organise labour in his "home cum research institution."[24] This distribution of labour and specialisation, as well as the collaborative nature of natural historical work, is manifest in Fabricius's description: "the daily workers, a group to which I have long belonged, have their own places, their own table, their own magnifying glass and their own drawer for their papers and things, and everyone uses everything with the same freedom that he would have at home."[25] It is important to note here that Fabricius explicitly emphasised the spatial as well as material preconditions of such distributed labour which allude to the artisanal workshops of the period. Fabricius use of the term "daily workers" and his general description of scholarly activities at Banks's house also evoke Martin Gierl's notion of the eighteenth-century university as "a factory of enlightenment."[26] In this sense, Banks's Soho Square apartments and collections could be called a factory or at least a workshop of natural history. In fact, Anke te Heesen has shown how workshops and production metaphors were also used by other naturalists, like the founder of the Berlin natural history society Friedrich Martini.[27]

A few pages later, Fabricius also mentioned work on the Florilegium, an illustrated volume on the botanical specimens from the Endeavour voyage: "The great and important botanical work is in constant progress. Downstairs, right next to the door, there is a separate room for the painters and copper engravers who work here continuously and daily."[28] Daily work frames both quotes and inspires a closer look at the participation of illustrators, engravers and other knowledge makers. It is however remarkable that the naturalists (the "daily workers" with their "magnifying glasses") in the first quote and the "painters and copper engravers" in the second quote are in fact working in the same building but separated spatially both in Fabricius's text (a few pages apart) and in Banks's house (on different floors of the building). This almost tangible tension of proximity and distance seems to define the relations between the different labourers in general.

At the same time, Fabricius clearly stresses that both groups, himself included, are "workers." On the one hand, this may originate from Fabricius's own fairly instrumental view of natural history as an academic pursuit closely connected to early modern Oeconomy and cameralist thinking, as it was for many contemporaries, first and foremost his teacher Linnaeus.[29] Conceptualising his own intellectual and practical engagement with natural history within the semantic field of work, Fabricius seemed to have also envisioned a new social role for academics in the related disciplines of economics and natural history. Fabricius laid out these issues in programmatic publications on

[24] Gascoigne 2003, on 70.

[25] Fabricius 1784, on 50. All English quotations from Fabricius's report on his visits to London follow the translation of the *Briefe* by Julie Neill, The Language Centre, University of Glasgow, commissioned by The Hunterian in 2007, used and amended here with permission of The Hunterian.

[26] Gierl 2005.

[27] Te Heesen 2004.

[28] Fabricius 1784, on 54.

[29] Koerner 2001. See also Rood 2016.

university and education reform later in his life but they are already visible in his report on scholarly life in London in the early 1780s.[30] On the other hand, Fabricius's sentiments undoubtedly reflect how contemporaries viewed the labour and social organization of natural history. Much as we do not have an image of work at Banks's house, the draughtsmen and -women, the collectors and the (enslaved) labourers in British colonies who were all part of the production process, also remain hidden, invisible and unnamed here. The juxtaposition of intellectual labour and manual labour in entomology was not as stark as in other fields of natural history, like geology or palaeontology. However, processes of "showing and hiding," which Barnett has so masterfully analysed, are at work in insect studies as well.[31]

This can be exemplified by how one of the most important German collectors and entomologists of the eighteenth century, the Regensburg parson Jacob Christian Schäffer (1718–1790) employed entomological labour, both figuratively as well as practically. Schäffer's collection was well known and visited by "the great and the good," among them Goethe, Bonny Prince Charlie, several noble women as well as fellow naturalists like Johann Christian Fabricius.[32] For his publications Schäffer worked with a considerable number of illustrators to produce his entomological treatises. While he acknowledged and foregrounded the important role of images in the formation of knowledge in entomology, he also clearly demarcated the social hierarchies of textual (i. e. academic or scholarly) knowledge production and visual (i. e. artisanal) support for natural history study (Figure 4).

For the frontispiece to Schäffer's three-volume textbook *Essays on insects* (*Abhandlungen von Insecten*) published in 1764, the Nuremberg draughtsman Johann Justin Preisler (1698–1771) depicted perhaps the most iconic figure in all of natural history illustration: the Greek multi-breasted goddess Demeter as the personification of nature herself. She is unveiled by the personification of knowledge and two putti record their observations, one in writing, the other in drawing. This triangle of nature, knowledge and observation and the twin activities of writing and drawing foreshadow Schäffer's own position on these issues. The preface to his *Abhandlungen* was a reprint of an earlier programmatic essay entitled: *Suggestions for the improvement and advancement of science serving the public good*.[33] The title of this publication clearly reflects the strong connection of natural history to state interests and economics, as in Fabricius's case. In both texts Schäffer identified the three important media of the *Naturwissenschaften*: systems, lexica and images. Even though he considered word and image side-by-side on equal terms, Schäffer did not consider those who created the latter to be equal to those who employed the former. In general, Schäffer's text reinforces the social hierarchies of his time and he used them to highlight the growing importance of the natural sciences among all

[30] See: Hünniger 2018b for Fabricius's cameralist thought and publications on education reform.

[31] Barnett 2019. Barnett also stresses that these boundaries were far from clear cut in the early modern period and practice often differed from ideology.

[32] For more on Schäffer, see: Szalay 2019.

[33] Schäffer 1763; Schäffer 1764.

Figure 4. Johann Justin Preisler and Gustav Philipp Trautner, frontispiece to Schäffer 1764, Bibliothek Zürich, Rar 1341, online: https://doi.org/10.3931/e-rara-29520 (accessed 23 April 2021).

social strata, from princes and scholars to farmers.[34] The latter as well as specialised professions, like hunters, tradespeople, etc. were important as helpers and contributors of specimens.[35] Schäffer acknowledged that their help was instrumental in procuring the material for his study but he certainly downplayed their knowledge, expertise and labour. His attitude resembles that of other learned naturalists towards fossil finders, for instance. Crucially, though, Schäffer mentioned those who collected or illustrated for him, some even by name.[36] He did admit that without these many helpers, he would not have been able to amass his collections. The sheer number of specimens in collections like Schäffer's could only be assembled by a great number of collectors. Like many of his colleagues, he was a "collecting collector" to use James Delbourgo's phrase.[37] Concerning payment, he only speaks of "tips" (*Trinkgelder*) in a footnote which seems to suggest that the labour was seen as minor and had not been sufficiently remunerated. At the same time this also manifested social distance and superiority.

Schäffer used his musings on the role of images also for his own self-fashioning as a text-creating scholar of high repute and a severe manager of

[34] Schäffer 1764, on I–III.

[35] See Andersson Burnett 2004.

[36] Schäffer 1764, on XX–XXII.

[37] Delbourgo 2017, on 202.

subordinate labour. According to him even the most skilled artist needed to be constantly supervised by a scholar who "has an exact and systematic knowledge ["Kenntnis"] of the objects to be depicted."[38] As he thought the same was true for those who produce the copperplate and colour the images, Schäffer's choice of words concerning his encounter with the artists and illustrators who worked for him is striking. Schäffer used a term usually limited to the training of dogs: "abgerichtet" (disciplined).[39] The strong semantic connection of disciplining an animal and the making of scientific disciplines through pedagogy, connected through their common root in the Latin for student, disciple is of course a function of the development of arts and science collaboration as well.[40] According to Schäffer, this "discipline" would "improve" (*verbessern*) the whole state of the natural sciences. Clearly, enlightenment politics of improvement went hand in hand with the social superiority of the improvers themselves.[41] This choice of words is not accidental, because Schäffer bitterly complained in his Foreword about the ingratitude of an employee, the goldsmith Johann Georg Beez, who had left Schäffer and found a more lucrative job in Berlin. After Beez had left, Schäffer "disciplined" Beez's sister Sophie and considered her extremely talented. According to Schäffer she had become a "master" very quickly. However, Schäffer immediately qualified his praise of her works though by complaining that her early death had delayed the progress of his natural history works. The sentence recording her early passing is even connected to her labour: "after she had drawn nearly one hundred species of fungi, she laid down, and died."[42] There is an uncanny disappointment in and lack of compassion for the artist palpable in Schäffer's words. Had he put too much pressure on the young woman? Did she die of exhaustion? Unfortunately, we do not have any further information. Sophie Beez's authorship of the images in Schäffer's work remain her legacy, made visible in her signature on the copper plates.

The collaboration of artist and scholar is expressed in similar terms in the household of the Count de Réaumur.[43] Mary Terrall has masterfully analysed the Count's household as an important site of knowledge production which also included the collaboration of servants and another well-known female illustrator-naturalist: Hélène Dumoustier, the main co-creator of knowledge in Réaumur's household.[44] The images shown here, however, were created by two of Reaumur's male illustrators, Jean-Baptiste Haussard and Philippe Simonneau.

[38] Schäffer 1764, on XIV.

[39] Ibid., on III. He also uses this term for other helpers (e. g. on XXI–XXII).

[40] See also Bleichmar 2012.

[41] On the politics of "improvement" in plantation botany, see also the contribution of Williams in this issue.

[42] Schäffer 1764, on XXV–XXVI: „Kaum daß sie gegen Hundert Schwammarten gemahlet hatte legte sie sich, und starb." Johann Georg and Sophie Beez's work for Schäffer is mentioned briefly in Nissen 1978, on 150.

[43] Daston and Galison, on 84–87.

[44] Terrall 2014.

Figure 5. Philippe Simonneau, vignette for René Antoine Ferchault de Réaumur, *Mémoires pour servir à l'histoire des insects*, vol. 2 (Paris: de L'Imprimerie Royale, 1736), premier mémoire, p. 1, ETH-Bibliothek Zürich, Rar 8716, online: https://doi.org/10.3931/e-rara-43038 (accessed 23 April 2021).

These specific images are selected here because they make the social hierarchies as well as the collaborative nature of knowledge production between leisure and labour clearly visible. Both images show several people catching insects. In the first, this seems more like a polite leisure activity undertaken by a group of upper-class men though not without physical engagement. In the second vignette a more socially diverse group of people is seen tending to and observing insects. Both intellectual as well as physical activities oscillate on a social spectrum. The homosocial setting (both regarding gender as well as class) in Figure 5 can be compared to typical upper-class activities like riding and fencing, which of course involved a certain physicality but may not be called labour. At the same time, it is obvious that insect collecting was a very physical activity which was, like fencing and riding, dependent on controlled movement, skill and acquired knowledge/practice. All of this was certainly also important for the activities of the person on the right-hand side of Figure 6 in the image's foreground. Judging from their dress, it is certainly a servant or employee.[45] Their task of removing the swarm from the nest was certainly more dangerous and physically challenging than the examination of the bees through the safe confines of the observational hives performed by the upper-class man and woman in the background. All activities however required skill and intellectual labour. In both vignettes entomology is not a solitary

[45] Terrall calls the figure a gardener. Terrall 2014, chapter 4. See also Spary 2000 for the labour/leisure distinctions at work in the Jardin du Roi.

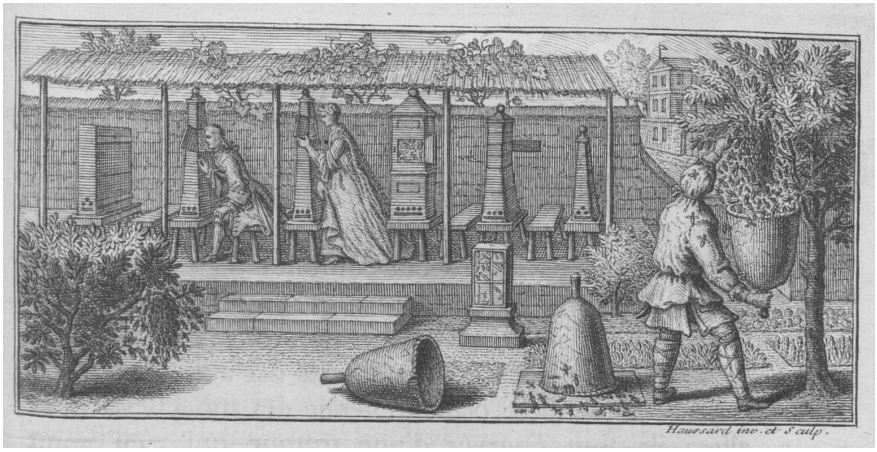

Figure 6. Jean-Baptiste Haussard, vignette for René Antoine Ferchault de Réaumur, *Mémoires pour servir à l'histoire des insects*, vol. 5 (Paris: L'Imprimerie Royale, 1740), premier mémoire, p. 1, ETH-Bibliothek Zürich, online: https://doi.org/10.3931/e-rara-42159 (accessed 23 April 2021).

endeavour but a collaborative or at least a sociable activity. In Reaumur's case it also reflects the social mechanics of aristocratic households.[46]

The more leisurely activity of Simmoneau's vignette takes us back to Johann Rudolf Schellenberg with whom this article began (Figure 7). Schellenberg's frontispiece for Johann Heinrich Sulzer's *Characteristics of Insects* (*Kennzeichen der Insekten*) depicts a male figure standing in front of a wall on which a female figure is seated.[47] As Brigitte Thanner has suggested, this may have had erotic connotations but the gestures, points of view of the figures as well as the collecting instruments depicted suggest a genuine engagement with entomology.[48]

This genuine engagement also produced expertise, which is clearly visible in the seven vignettes, Schellenberg produced to introduce the seven orders of insects. This includes the depiction of the insects themselves but also a genuine knowledge of collecting practices and equipment. Schellenberg used these vignettes to showcase his own skills, not only as an illustrator but also as a naturalist. This may also have included social aspirations as Schellenberg's *Erholungs Stunden* manuscript suggests. Both leisure and labour and especially the time required for them were socially specific as to what counts as work.

[46] Labour practices and the social organization of insects themselves were of course favourite topics of insect studies since the Renaissance. A full labour history of entomology would also need to incorporate a multispecies perspective. On the history of insects as a mirror for human societies, see Johach 2020.

[47] Sulzer 1761.

[48] Thanner 1987, on 108. These two activities however were not necessarily mutually exclusive.

Figure 7. Johann Rudolf Schellenberg, frontispiece to: Johann Heinrich Sulzer, *Die Kennzeichen der Insekten* (Zürich: Heidegger & Comp., 1761), Zentralbibliothek Zürich, NNN 828, online: https://doi.org/10.3931/e-rara-25036 (accessed 23 April 2021).

4. Showing off Labour – The Artisan/Scholar Visualises Entomological Work

Schellenberg was a painter's son and artist from Wintherthur who established himself firmly and steadily as a sought-after draftsman and naturalist. Seventeen years after Schellenberg worked for Sulzer, another Swiss entomologist and painter, Johann Kaspar Füssli, described him as not only a "painter but also a great insect scholar."[49] Clearly Schellenberg had achieved credibility and esteem. Yet his artistic talents as well as his knowledge about insects and

[49] Füssli 1778, on II.

the processes of collecting, taxonomy and image making are already very visible in this early work. As early as 1753, when he was thirteen, Schellenberg produced many insect illustrations for the eminent naturalist Johannes Gessner who also provided a preface to *Kennzeichen der Insekten.* In this preface, Gessner used a trope that we have already seen in Schäffer's description of how he taught artists. Gessner likewise insinuating that it was the "learned Dr. Sulzer" who had "instilled a great disposition and knowledge of insects" in Schellenberg. Gessner also stressed however that the reader may expect correct drawings of insects because they had been made by an "expert and amateur of insects" ("Kenner and Liebhaber der Insekten").[50] Gessner's phrase and his use of the term *Kenner* in conjunction with *Liebhaber*, especially in conjunction, highlights again the complicated history of concepts like expert and amateur in various European languages, which do not translate well.[51] However, by paying close attention to these concepts, we can see that both Gessner and Sulzer mix their respect and appreciation for Schellenberg always with a sense of social superiority, in as much as Sulzer called Schellenberg "my painter" throughout his preface.

Schellenberg was born in Winterthur, Switzerland in 1740 into a well-known artist family. He first trained with his maternal grandfather Johann Rudolf Huber and then with his father Johann Ulrich Schellenberg at their drawing school and workshop. This collaboration with other naturalists continued throughout his life and includes well-known names like Johann Bernhard Basedow, Johann Friedrich Blumenbach and Johann Kaspar Lavater, for whose infamous physiognomy books he provided many illustrations. Around 4,000 of his insect watercolours still exist today at Winterthur City Library. Towards the end of his life, he became a prolific author on entomology and also artistic practices, publishing an introduction to etching in 1795 and co-authoring several monographs on entomology in the late 1790 and early 1800s.[52]

The *Kennzeichen der Insekten* is a free translation and annotation of Linneaus's insect systematics. Linnaeus divided the class Insecta into seven orders, based chiefly on the existence and form of the wings, choosing terminology already present in classical antiquity as well as neologisms.[53] As the putti also are depicted with insect wings (not the more common bird wings) there is an obvious parallel here.[54] In addition to the twenty-four plates of several insect species and orders and their specific characterises as well as

[50] Sulzer 1761, on XV.

[51] Pandora 2016; Star and Griesemer 1989.

[52] Schellenberg 1795; Clairville and Schellenberg 1798; Schellenberg 1800a and b; Schellenberg 1802; Schellenberg 1803.

[53] Winsor 1976.

[54] See https://wellcomecollection.org/works/ckpu87zj (accessed 23 April 2021).

detailed anatomy, Schellenberg also contributed fascinating title vignettes for all seven of the Linnean classes of insects.[55]

In a letter to the Zurich physician Salomon Schinz, which Sulzer had included as a preface to his book, he recounted an episode where he had seen Schellenberg teaching the characteristics of these classes to a young girl and then suggested that Schellenberg draw vignettes for each order. This pedagogical tool is significant; but the vignettes do so much more than just depict the important differences in insect taxonomies. They make natural historical labour as well as the imaginaries of participation in entomology visible. In fact, the "heightened visibility" of work(ers) in Schellenberg's vignettes renders them especially significant for a history of entomological labour.[56] In contrast to learned earth scientists of the period who did not depict their own labour but that of working fossil finders, Schellenberg brings a "heightened visibility" to his own labour as an artist-entomologist. As in Barnett's study, however, Schellenberg's images accomplish a strikingly performative function, especially in the construction of the artisan-entomologist persona. Sulzer's framing of Schellenberg's pedagogical skills in the preface contributes to this further. The images themselves need to be read in conjunction with Sulzer's preface, the artist/scholar's biography and natural history practices as well as the history of collaboration as described in the previous chapter in order to reveal their multi-layered meaning (Figure 8).

The first order, beetles (*coleoptera*), sets the scene for the sophistication of Schellenberg's art and science. The insect is depicted with wings open, showing the upper case and the lower wing, which is the defining characteristic of the order. Strikingly, the process of visualising this insect is itself depicted. One putto is using the tools of the trade of copper plate engravings, a hammer and a needle, the other is holding the wings apart.[57] As in many images that follow, the putti symbolising and actually doing the work of the artist/scholar never work on their own and are always seen in pairs or groups (Figure 9).

Already the vignette of second class, true bugs or *hemiptera*, opens up many levels of interpretation First, Schellenberg's name appears very prominent on the stone on the left-hand side as do the typical Latin abbreviations of "inv." and "fec." marking Schellenberg as the "inventor" and maker of this illustration. In early modern book illustrations these tasks were often distributed among several skilled artisans and it is further testament to Schellenberg's labour and efforts that he took on both these tasks.

Daston and Galison already pointed to the differences in the visibility of artist versus naturalists in early modern scholarly publications. The names of the latter appeared on the title pages "while the names of the artist and the

[55] It is important to note that Sulzer used the last paragraphs of Linnaeus's famous "oeconomy of nature" dissertation from 1749 as an epithet to his book highlighting the strong entanglements between natural history and (o)economy. See: Koerner 2001; Müller-Wille 2003. It is tempting to connect the seven vignettes to six vignettes Peter Paul Rubens made for François de Aguilon's six books on optics. See Heilbron 2000, on 13. This is beyond the scope of this article though.

[56] See: Barnett 2019, on 249.

[57] For tools as an object of analysis in the history of natural history, see Hünniger 2018a.

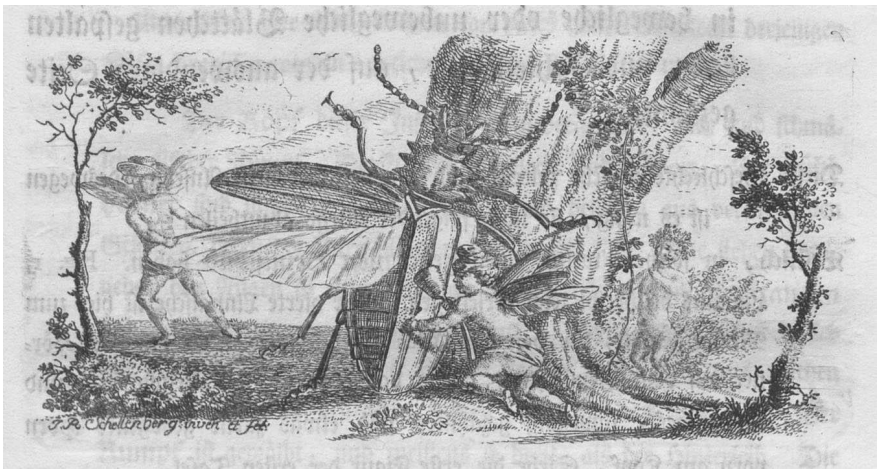

Figure 8. Johann Rudolf Schellenberg, vignette: first order, in: Johann Heinrich Sulzer, *Die Kennzeichen der Insekten* (Zürich: Heidegger & Comp., 1761), p. 45, Zentralbibliothek Zürich, NNN 828, online: https://doi.org/10.3931/e-rara-25036 (accessed 23 April 2021).

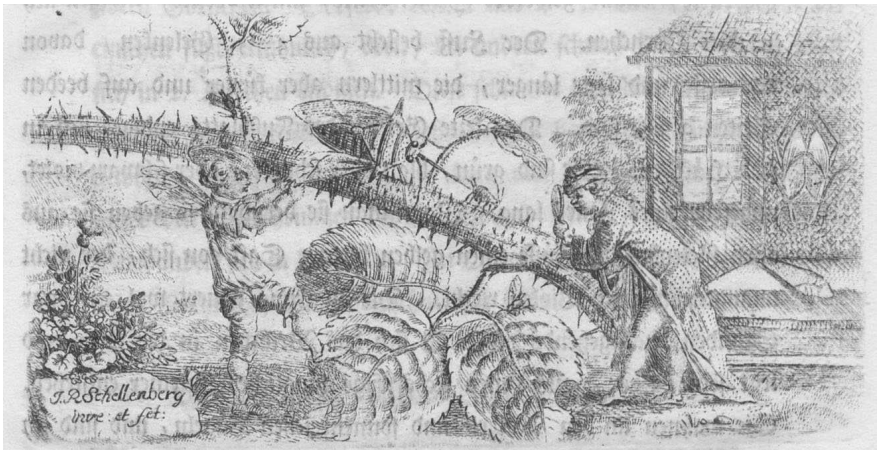

Figure 9. Johann Rudolf Schellenberg, vignette: second order, in: Johann Heinrich Sulzer, *Die Kennzeichen der Insekten* (Zürich: Heidegger & Comp., 1761), p. 94, Zentralbibliothek Zürich, NNN 828, online: https://doi.org/10.3931/e-rara-25036 (accessed 23 April 2021).

engraver huddled in small, faint print at the bottom of the plates."[58] Huddled they were, invisible they were not. Quantitative methods and the availability of large datasets of digitised sources, provide ample opportunity for making a greater variety of actors visible in precisely these small prints. Digitisation initiatives, like the Biodiversity Heritage Library and community-based

[58] Daston and Galison 2007, on 88.

crowdsourcing, like www.binomia.net have developed recording practices that render all named contributors visible and even more importantly findable in a way in which older library catalogues could not have done. The Stuttgart Database of Scientific Illustrators (https://dsi.hi.uni-stuttgart.de) helps further to identify all persons who were involved in the production of scientific literature. Further digitisation and especially the application of integrated or unifying authority files to encoded and marked-up text will reveal even more forgotten knowledge makers of the past. As is widely acknowledged today, women played an important part in the formation of natural knowledge in the early modern period and belonged to the most invisible labourers in the production processes. One of the most prolific female knowledge makers in the German speaking lands was the artist Eleonara Maria Hochecker from Frankfurt.[59]

The authors of entomological handbooks were largely university-trained scholars who employed illustrators from a range of social backgrounds. This is especially apparent in the lavishly illustrated *Papillons d'Europe, peints d'après nature*, which was published in Paris in eight volumes from 1779 to 1792. The wealthy bureaucrat and collector Gigot D'Orcy employed almost 20 engravers and illustrators from France and Germany to illustrate this magisterial series. This work exemplifies the collaborative nature of entomological book production: it included 350 plates with at least 10 times as many species depicted in these plates. The sponsorship of wealthy patrons and the involvement of a large number of collectors who subscribed was the only way to print the 250 exquisite copies. Hochecker is always mentioned as one of the contributors but the extent of her involvement was never quantified. Through a quantitative analysis of the signatures of the artists on the copperplates, Hochecker appears as *the* main contributor of D'Orcy's book (Figure 10).

The two figures in the second vignette are hardly putti anymore but have human clothes, one of them even the scholarly housecoats that we have seen in Blankaart's image already. Again, tools come in prominently, here the magnifying glass. Also, as in Lesser's image, the field and the house are visible as the two important sites of observation but also habitats of insects as the bug on the wall indicates. Here, however, observation is happening in the field and the interaction between plants and insects, as between insects themselves, is foregrounded. We see a bug feeding on an aphid as well another eating the leaves of the plant. The prominence of the thorns of the plant as well as the sting of the insect is too obvious to miss in this symmetrical natural history. These "ecological" observations, to use an anachronistic term, are quite rare in the taxonomic literature but have not escaped early modern naturalists. Both the vignettes as well as the illustrations of the actual species are testaments to Schellenberg's artistic skills and mastery as the details of the insect's anatomy are astounding.

Juxtapose the vignette of the third order with an image depicting exemplary species of butterflies, *lepidoptera* (Figure 11 and 12): the comparison underscores both Schellenberg's entomological expertise as well as his knowledge of the

[59] Kern 2007.

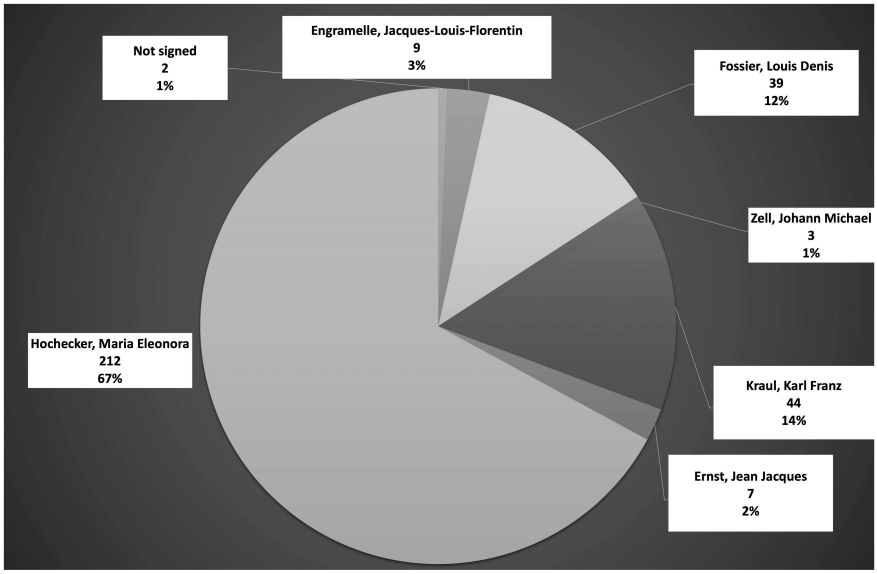

Figure 10. Illustration of Hochecker's name being present on 212 of the 350 plates to D'Orcy's book.

Figure 11. Johann Rudolf Schellenberg, vignette: third order, in: Johann Heinrich Sulzer, *Die Kennzeichen der Insekten* (Zürich: Heidegger & Comp., 1761), p. 113, Zentralbibliothek Zürich, NNN 828, https://doi.org/10.3931/e-rara-25036 (accessed 23 April 2021).

practices and difficulties of insect collecting and illustration. Schellenberg chose to depict a female figure here, using a rake to collect the scales of a butterfly. The scales and their preservation in collection are very important for lepidopterists as they make up the colour of the animal and need to be studied closely and carefully preserved. This process is visible in the species image

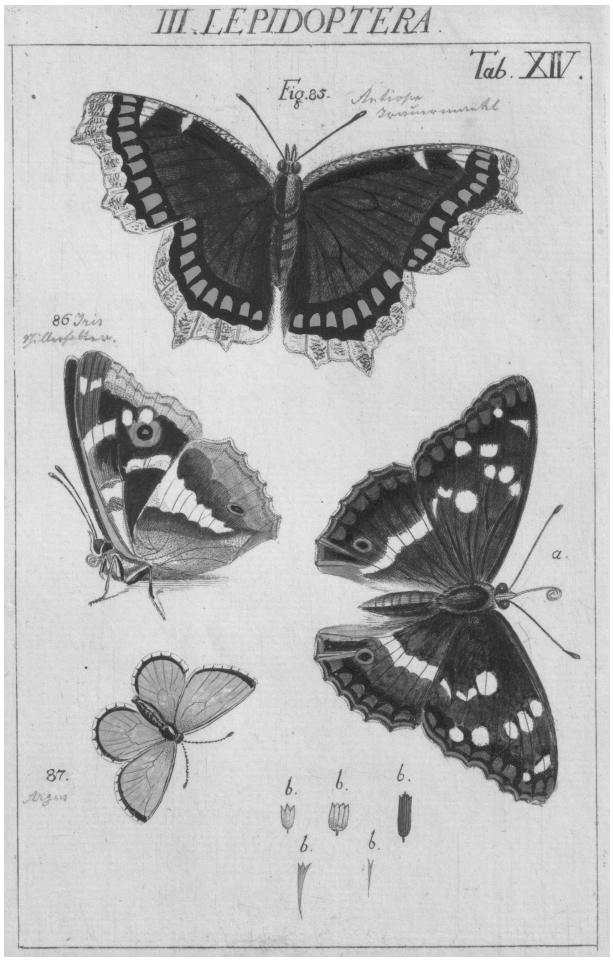

Figure 12. Johann Rudolf Schellenberg, scales of butterflies in: Johann Heinrich Sulzer, *Die Kennzeichen der Insekten* (Zürich: Heidegger & Comp., 1761), plate XIV, Zentralbibliothek Zürich, NNN 828, online: https://doi.org/10.3931/e-rara-25036 (accessed 23 April 2021).

where Schellenberg illustrates the differences between scales. The female figure also stands for the gendered division of labour in natural history, as women usually worked as colourists. It is remarkable in this context that the usual role of female characters as personifications of either nature (as in the frontispiece to Schäffer's *Abhandlung*), the sciences or knowledge is completely missing from Schellenberg's vignettes.[60]

We also see the collaborative nature of insect studies again and the importance of tools. The flying putto holds a so-called scissor or forceps net

[60] See: e. g. Barnett 2019 and Bewell 2006 for such figures.

which was a recent innovation in catching insects, specifically butterflies.[61] This instrument, invented around 1755 in Sweden, guaranteed a more careful collecting of butterflies which made sure all their scales stayed intact. This is further evidence of Schellenberg's familiarity with state-of-the-art entomology. The vignettes can therefore be interpreted as Schellenberg's business cards: he is in fact speaking to us, in his own visual language, about the labour of natural history, which he understood perfectly (Figure 13).[62]

The fourth vignette depicting net-winged insects (*Neuroptera*) is another striking example of Schellenberg's mastery which is noticeable here in the fine lacewings of the insects behind which the features of the putto on the left-hand side are visible, another token of the artist's talents. This vignette also depicts the most literal representation of physical labour. Both putti carry a heavy insect and the one in front bends visibly from its weight. Although insect collecting did not usually demand the same kind of "hard" extractive work as digging for fossils, comparing figure 13 to the frontispiece to Antoine-Joseph Dezallier d'Argenville's *Histoire naturelle éclaircie,* where labour is so "strikingly visible," in Lydia Barnett's words, is instructive. In this image: "a classicized queen stood for elite naturalists and collectors like d'Argenville who pursued the science of oryctology, the trio of well-muscled workmen symbolized the non-elite men whose labour made those subterranean specimens available for

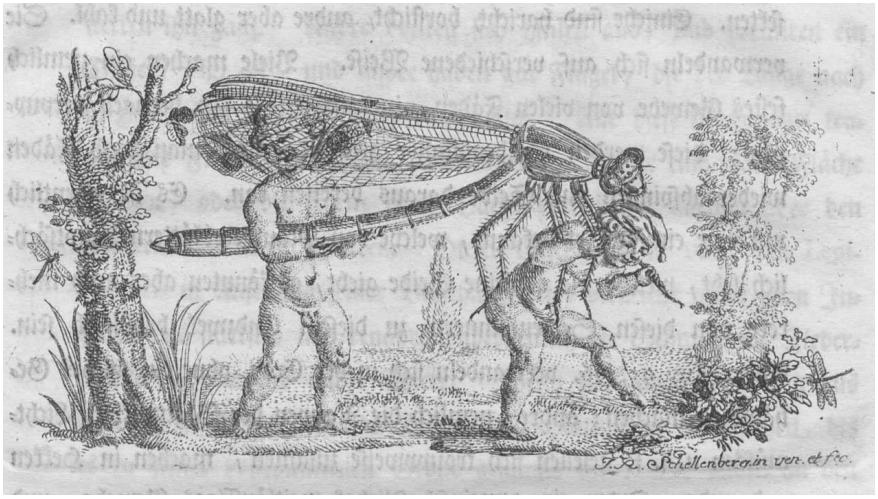

Figure 13. Johann Rudolf Schellenberg, vignette: fourth order, in: Johann Heinrich Sulzer, *Die Kennzeichen der Insekten* (Zürich: Heidegger & Comp., 1761), p. 128, Zentralbibliothek Zürich, NNN 828, https://doi.org/10.3931/e-rara-25036 (accessed 23 April 2021).

[61] The female figure in the frontispiece also holds a scissor-net.

[62] Schellenberg's entrepreneurial mind is also visible in his own book-keeping, see Thanner et al 1987, on 29. On science, visual culture and commerce in general, see Margócsy 2014.

natural inquiry and public display."[63] Careful work was also involved in insect collecting more generally, as the putto on the right-hand side of Schellenberg's fourth vignette seems to experience stings from the legs of the animal and as his next vignette also shows (Figure 14).

The species in the fifth order, *hymenoptera*, which includes sawflies, wasps, bees, and ants, are of course known for their stinging and biting abilities but also as producers of honey in the case of bees, which is depicted at the left-hand background with beehives, a notable symbol for industry.[64] Catching those insects was a difficult matter as the vignette clearly shows, including hard work. In this sense, the agency of the non-human animals themselves becomes visible, as in the sixth vignette (Figure 15).[65]

The final two vignettes, which Schellenberg used to introduce the order of *diptera*, flies and the wingless insects, *aptera*, in all their various forms are more playful than the others. In an almost symmetrical posture to the putto, the insect depicted in the sixth vignette seems to be as interested in itself as the putto is. As flies are maybe the closest to human habitation and quotidian life, it is probably this proximity which is symbolised here. Their extraordinary flying techniques are then mirrored in another symmetrical allusion in the putti's fancy flight and the rapid movement of their hindwings at the top right corner of the image. Again, Schellenberg shows off his astute observation skills and experience in insect studies very skilfully – but in a manner that may have only been visible to other equally astute observers. This almost playful symbolism is repeated and heightened in the seventh and last vignette (Figure 16). The seventh class actually included *arachnids* and *crustaceans*, which today are no longer counted among insects. The vignette depicts this wide variety but also a great amount of play and fun on the side of the putti at least. More prominent than the insects or putti is the collecting equipment in the foreground and Schellenberg's specific attention to tools may have come from his artisanal sensibilities about the importance of tools.

In summary, Schellenberg's seven vignettes display a wide variety of practices, tools and possible encounters between various human and non-human actors in the field of insect collecting, as well as the (gendered) divisions of labour in natural history observation and illustration. A close reading of such images against the background of the general developments as outlined in the first part of this article, reveals the possible motives and experiences behind the creation of these images. To use an important entomological instrument metaphorically, this microscopic study of Schellenberg's vignettes was enhanced by their availability as digital images and the possibilities of enlargement. Close inspection certainly helps in making their social dynamics visible. The production processes themselves depended on distinct work practices and the collaboration and involvement of many contribu-

[63] Barnett 2019, on 246. The image can be accessed here: Hyacinthe Collin de Vermont and Pierre Quentin Chedel, frontispiece to: Antoine Joseph Dézallier d'Argenville, *Histoire naturelle éclaircie dans une de ses parties principales, l'oryctologie*, Paris 1755, ETH-Bibliothek Zürich, Rar 1306, online: https://doi.org/10.3931/e-rara-13519 (accessed 23 April 2021). Yet a comparative case from entomology, Henry Smeathman's essay on termites, is analysed by Douglas and Driver 2005.

[64] The important role of hymenoptera in pollination was not known at Sulzer's time though.

[65] For more on non-human agency in entomology see Hünniger 2017.

Figure 14. Johann Rudolf Schellenberg, vignette: fifth order, in: Johann Heinrich Sulzer, *Die Kennzeichen der Insekten* (Zürich: Heidegger & Comp., 1761), p. 139, Zentralbibliothek Zürich, NNN 828, https://doi.org/10.3931/e-rara-25036 (accessed 23 April 2021).

Figure 15. Johann Rudolf Schellenberg, vignette: sixth order, in: Johann Heinrich Sulzer, *Die Kennzeichen der Insekten* (Zürich: Heidegger & Comp., 1761), p. 157, Zentralbibliothek Zürich, NNN 828, online: https://doi.org/10.3931/e-rara-25036 (accessed 23 April 2021).

tors of diverse social hierarchies. It is not unlikely that these hierarchies prevented Schellenberg from publishing his own entomological observations as he waited until the dawn of the nineteenth century to begin to publish these, when he was already sixty years old.

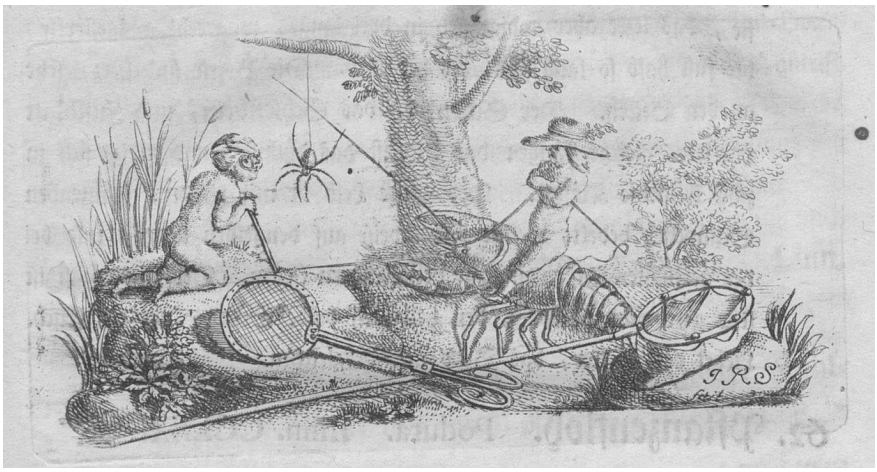

Figure 16. Johann Rudolf Schellenberg, vignette: seventh order, in: Johann Heinrich Sulzer, Die Kennzeichen der Insekten (Zürich: Heidegger & Comp., 1761), p. 177, Zentralbibliothek Zürich, NNN 828, online: https://doi.org/10.3931/e-rara-25036 (accessed 23 April 2021).

5. Conclusion

This interpretation of the visual representation of labour in European insect studies and natural history practices from the late seventeenth to the early nineteenth century has revealed the diversity of the "productive forces" in insect studies and the social imaginaries of participation in the depictions and narrations of labour. Scholarly traditions as well as social conditions of both manual and intellectual labour blurred the boundary between labour and leisure as well as that between scholar and artist. It was important for contemporary actors to show both aspiration and skill in several kinds of labour and they framed their own work in these categories, not only in images but also in texts. Furthermore, this labour was almost always conceptualised in the collective, from Fabricius's and his co-workers at Banks's collections to Schaeffer's and Reamur's households and finally to Schellenberg's scholar/artist putti. Of course, social hierarchies remained important; but as Lydia Barnett, and as others have also argued, premodern science was far less socially homogenous than previously thought.[66]

In the nineteenth and twentieth centuries the productive forces of natural history further diversified, and examples of women entomologists became more widespread, including female authors of entomological collecting manuals.[67] But alongside these positive developments, the sciences, including entomology, were heavily involved and dependent on the exploitation of and violence

[66] Barnett 2019, on 246.

[67] See: e. g.: Opitz 2004; Jermyn 1836.

towards humans and other species and environments, within and outside Europe.[68]

Finally, as historians of science and knowledge we might also re-conceptualise our own daily lives in labour categories to consider how we too depend on the in/visible labour of our peers, students and academic administrations as well as cultural and bio-cultural heritage institutions.

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[68] See: Das and Lowe 2018.

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